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(54) Title: FERTILISER

(57) Abstract: A fertiliser is provided which contains both an organic and an inorganic component. The fertiliser is in granular form and the mass ratio of organic and inorganic component is in the range 20:80 to 50:50.

FERTILISER

BACKGROUND OF THE INVENTION

This invention relates to a method of making a fertiliser.

Good soil management requires the addition from time to time of fertiliser in the form of an organic component such as manure or compost and an inorganic component such as various trace elements and minerals. Fertilisers which contain both an organic component and an inorganic component are known in the art. One such fertiliser is described in South African Patent No. 91/2431. The fertiliser described in this patent comprises an organic carrier in particulate form and at least one inorganic fertilising component in intimate contact with the organic carrier particles, so that the composition is in particulate form. A disadvantage with this fertiliser is that fine powder is generated in storage of the fertiliser and in its application to a locus. The fine powder creates a hazard for the person applying the fertiliser to a locus and is wasteful.

There is a need for a fertiliser which contains both an organic component and a high inorganic component and which can be applied to a locus in an effective and efficient manner.

SUMMARY OF THE INVENTION

According to the present invention, a fertiliser contains both an organic component and an inorganic component and has the following characteristics:

i) it is in granule form; and

ii) the mass ratio of organic component to inorganic component is in the range 20:80 to 50:50, preferably 20:80 to 35:65.

According to another aspect of the invention, a method of producing a fertiliser as described above includes the steps of producing a mix of organic component and inorganic component having a consistency suitable for granulation and granulating the mix.

The water content of the mix, to provide that mix with the consistency suitable for granulation, will generally be in the range 15 to 30% by mass, preferably in the range 20 to 30% by mass, and more preferably in the range 22 to 24% by mass.

In one form of the method, the mix of organic and inorganic components prior to the granulation step, may contain less than 12% by mass water and the water content of the mix is increased to a consistency suitable for granulation.

In another form of the method, the organic component in the mix may contain at least 60% by mass, typically at least 80% by mass, water, and dry solids are added to the mix of organic and inorganic components to bring it to a consistency suitable for granulation, prior to the granulation step. The dry solids added are preferably a mixture of dry organic and inorganic components, and particularly granular fertiliser of the invention which is re-cycled.

In another form of the invention, the organic component in the mix may contain at least 60% by mass, typically at least 80% by mass, water, the inorganic component is added to the organic component to produce a mix and the mix is fluidised in a fluidised bed drier to produce a fertiliser in granule form.

DESCRIPTION OF EMBODIMENTS

The fertiliser of the invention is characterised by containing both an organic component and an inorganic component with the content of the inorganic component being relatively high. The fertiliser is in granule form. The granules are preferably essentially spherical in shape and preferably have a crushing strength of at least 2,5 kg on 4 mm in diameter granules when measured by the standard compression test method such as that described in PP291 of the Fertilizer Manual of the International Fertilizer Development Centre first published 1967. Such a granule is free flowing in a planter, for example, and does not crush during handling or in transport. The components of the granules do not segregate and do not create any significant dust when being applied to a locus, such as an agricultural field. Each granule will have a relatively uniform composition and does not have an unpleasant odour. The water content of each granule is generally less than 5 percent by mass. The diameter of each essentially spherical granule is typically 1 to 5 mm, preferably 2 to 4 mm.

In one typical example of the invention, the fertiliser contains 30 percent by mass of an organic component and 70 percent by mass of an inorganic component.

The inorganic component will preferably contain nitrogen (N), phosphate (P) and potassium (K), and optionally one or more trace elements. Suitable inorganic compounds for the inorganic component are potassium chloride, potassium sulphate, monoammonium phosphate, superphosphate, gypsum, magnesium sulphate, a boron source such as boric acid, a nitrogen source such as ammonium sulphate or urea and mixtures thereof.

The inorganic component will typically contain 20 to 25 percent by mass of an aggregate of nitrogen, phosphate and potassium.

The inorganic component may include an effluent, particularly a waste effluent. For example, the inorganic component may be the raffinate from an industrial phosphoric acid manufacture. Such a raffinate will typically contain about 10% by mass sulphuric acid and 25% by mass phosphoric acid. This raffinate may be neutralised with ammonia and thereafter used as, or as part of, the inorganic component.

The inorganic component may also be precipitated phosphate from stored fertiliser phosphoric acid, waste ammonia from coke production or waste pickle liquor, containing nitrates and calcium, from stainless steel manufacture.

The organic component will typically be a manure such as chicken manure, pig manure or cattle manure or sewage sludge. In the case of a manure, the water content is generally fairly low in comparison with sewage sludge. The organic component may also be an organic rich liquid effluent from fermentations such as yeast, citric acid and antibiotic production or a protein rich effluent such as a fish factory wash liquor.

The granular fertiliser of the invention may be produced by a method which includes the steps of producing a mix of the organic component and inorganic component having a consistency suitable for granulation and thereafter

granulating the mix. The granulation preferably takes place in any known granulator such as a fluidised bed granulator or a rotary kiln granulator.

The mix will typically have a water content in the range 15 to 30%, preferably 20 to 30%, by mass to render it suitable for granulation. Depending on the water content of the organic component, different methods may be employed to produce a mix suitable for granulation.

In one form of the invention, the organic component is a manure containing a relatively low water content. A mix produced from such a manure will typically have less than 12% by mass water. In this case, the water content of the mix is increased prior to granulation.

When the organic component contains a much higher content of water, as in the case of sewage sludge, then dry solids may be added to the mix of organic and inorganic components prior to granulation. The dry solids which are added are preferably a mixture of organic component and inorganic components which has a water content of less than 5% by mass.

The water which is added may be water itself, water containing an organic component such as molasses, or a liquid effluent.

Examples of the invention will now be described. In a first example, a manure which is relatively dry, for example, a chicken manure, screened clean and containing less than 20% by mass water, is fed together with the inorganic component to a blender, such as a batch ribbon blender, to mix the organic and inorganic components. The mix is then delivered to a feed hopper. The relatively dry mix is fed to a mixer, typically a paddle mixer, where water is added to create a mix having a consistency suitable for granulation. The mix is then fed to a rotary kiln granulator in which granules having the desired

characteristics as described above are produced. The organic and inorganic components which may be used in this example are:

Organic Component (30% by mass)

Chicken manure containing 18% by mass water.

Inorganic Component (70% by mass)

Potassium chloride	9 %
Monoammonium phosphate	6 %
Recovered phosphate	7 %
Urea	10%
Ammonium sulphate	30%
Magnesium sulphate	3 %
Gypsum	4 %
Trace elements e.g. boron, iron and manganese	1 %

It was found that an organic/inorganic mix having the composition described above and a water content of 22 to 24% by mass produced particularly effective granules. Such granules were essentially spherical in shape and had a crushing strength exceeding 2,5 kg for 4 mm diameter granules.

In a further example of the invention, granules which were essentially spherical in shape and had a crushing strength exceeding 2,5 kg for 4 mm diameter granules were produced as described above, save that the recovered phosphate was replaced by a raffinate from an industrial phosphoric acid manufacture neutralised with ammonia.

In a further example of the invention, a sewage sludge having a water content of 80% by mass was mixed with an inorganic component of the type described above. The blend or mix was wet and found to have a water content exceeding 50% by mass. The wet mix or blend was then introduced into a fluidised bed drier and fluidised with the addition of heat. Produced in the drier was a mass of essentially spherical granules, each having a crushing strength exceeding 2,5 kg for 4 mm diameter granules.

The granular fertiliser of the invention may be applied prior to planting, at planting or post-emergence as a top dressing. The granules are free-flowing and do not crush during handling or in transport. Further, the granules do not segregate as a blend does and are dust free when applied to a locus. Further, the granules contain no waxes or other binder agents reducing the cost and complexity of manufacture.

CLAIMS

1. A fertiliser containing both an organic component and an inorganic component and having the following characteristics:

   i) it is in granular form; and

   ii) the mass ratio of organic component to inorganic component is in the range 20:80 to 50:50.

2. A fertiliser according to claim 1 wherein the mass ratio of organic component to inorganic component is in the range 20:80 to 35:65.

3. A fertiliser according to claim 1 or claim 2 wherein the granules are essentially spherical in shape.

4. A fertiliser according to claim 3 wherein the diameter of each granule is in the range 1 to 5 mm.

5. A fertiliser according to claim 3 wherein the diameter of each granule is in the range 2 to 4 mm.

6. A fertiliser according to claim 4 or claim 5 wherein the granules have a crushing strength of at least 2,5 kg on 4 mm in diameter granules when measured by the standard compression test method as described in PP291 of the Fertilizer Manual of the International Fertilizer Development Centre.

7. A fertiliser according to any one of the preceding claims wherein the water content is less than 5% by mass.

8. A fertiliser according to any one of the preceding claims wherein the inorganic component contains nitrogen, phosphate and potassium.

9. A fertiliser according to any one of the preceding claims wherein the inorganic component contains 20 to 25% by mass of an aggregate of nitrogen, phosphate and potassium.

10. A fertiliser according to any one of the preceding claims wherein the inorganic component is selected from potassium chloride, potassium sulphate, monoammonium phosphate, superphosphate, gypsum, magnesium sulphate, a boron source, a nitrogen source, and mixtures thereof.

11. A fertiliser according to claim 10 wherein the boron source is boric acid or salt thereof.

12. A fertiliser according to claim 10 or claim 11 wherein the nitrogen source is selected from ammonium sulphate and urea.

13. A method of producing a fertiliser according to any one of the preceding claims including the steps of producing a mix of the organic component and the inorganic component having a consistency suitable for granulation and granulating the mix.

14. A method according to claim 13 wherein the water content of the mix of organic and inorganic components is in the range 15 to 30% by mass.

15. A method according to claim 13 wherein the water content of the mix of organic and inorganic components is in the range of the mix of organic and inorganic components is 20 to 30% by mass.

16. A method according to claim 13 wherein the mix has a water content in the range of 22 to 24% by mass.

17. A method according to any one of claims 13 to 16 wherein the mix of organic and inorganic components, prior to the granulation step, contains less than 12% by mass water, and the water content of the mix is increased to a consistency suitable for granulation.

18. A method according to any one of claims 13 to 17 wherein the organic component is selected from a manure containing less than 20% by mass water.

19. A method according to claim 18 wherein the organic component is selected from chicken manure, pig manure and cattle manure.

20. A method according to any one of claims 13 to 17 wherein the organic component contains at least 60% by mass water and dry solids are added to the mix of organic and inorganic components to bring it to a consistency suitable for granulation, prior to the granulation step.

21. A method according to claim 20 wherein the organic component contains at least 80% by mass water.

22. A method according to claim 20 or claim 21 wherein the organic component is sewage sludge.

23. A method according to any one of claims 13 to 22 wherein granulation takes place in a fluidised bed granulator or rotary kiln granulator.

24. A method of producing a fertiliser according to any one of claims 1 to 12 including the steps of providing an organic component containing at least 60% by mass water, adding the inorganic component to produce a mix and fluidising the mix in a fluidised bed drier to produce the fertiliser.

25. A fertiliser according to claim 1 substantially as hereinbefore described.

26. A method according to claim 13 substantially as hereinbefore described.

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C05G3/00 C05F3/00 C05F1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C05G C05F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	the whole document	23,24
X	US 5 466 273 A (CONNELL LARRY V) 14 November 1995 (1995-11-14) the whole document	1-22,25, 26
X	EP 0 314 159 A (KOVINOTEHNA CELJE N SOL O TOZD) 3 May 1989 (1989-05-03) the whole document	1-21,25, 26
X	US 5 118 336 A (BIEZ GEORGES) 2 June 1992 (1992-06-02)	1,2, 7-21, 23-26
Y	the whole document	23,24

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Saldamli, S

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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